Clinical and USG Diagnosis versus Histopathological Outcome in Cases of Hysterectomy

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Abstract: Hysterectomy is the most commonly performed gynaecological operation throughout the world. Fewer studies have been performed describing the relationship between pre-operative clinical, ultrasonological diagnosis and histopathological outcome. This study was undertaken to correlate the different clinical findings and parameters of the patients with USG findings which was later confirmed by histopathological evaluation of the specimen. It was a prospective observational study over a period of one year from June 2014 to May 2015 which was conducted in Department of Obstetrics and Gynaecology, Calcutta National Medical College & Hospital, Kolkata, a tertiary care referral hospital. In this study patient was first examined clinically and then pelvic sonographic evaluation was done. Only clinically benign cases were included in this study. A total of 100 cases were studied. The mean age of the patients was 45 years with high incidence in multipara and most common complaint of abnormal menstrual bleeding followed by prolapse. Ultrasound detected 68% fibroids and 64% of adenomyosis. The commonest preoperative indication based on clinical and USG findings was fibroid uterus (38%).The most common route was vaginal (53) including non-descent vaginal hysterectomy. The most common pathology identified was leiomyoma (36%) followed by adenomyosis (31%).One missed malignant case of leiomyosarcoma was detected. Out of the clinical diagnosis, ultrasonographical findings and histopathological diagnosis, histopathological diagnosis was found to be the gold standard to ensure the final diagnosis.
Keywords: Hysterectomy, Histopathology, Leiomyoma, Adenomyosis, Prolapse, Leiomyosarcoma

INTRODUCTION

Hysterectomy is the commonest gynaecological surgery all over world [1]. The abdominal removal of the uterus is called 'total abdominal hysterectomy' while the removal of the uterus by the vaginal route is termed as 'vaginal hysterectomy. It was first performed in 1507 by Berengarius of Bolonga through the vaginal route. But the credit for first vaginal hysterectomy was given to Langen, back in 1813. The first total abdominal hysterectomy with bilateral salpingo-oophrectomy was done by Clay in 1844 [2]. Hysterectomy is the most commonly performed surgical procedure in peri and post-menopausal women. It is the second most common surgical procedure in USA [3]. In India hysterectomy rate is (6%) as compared to western countries (10 -20 %) [4]. since early 20 century, hysterectomy is a definite treatment of pelvic pathology including fibroid, adenomyosis, endometriosis, pelvic inflammatory disease and cancer of reproductive organs. Hysterectomy is considered as life-saving procedure in

women with certain type of cancer and in acute uterine haemorrhage. It also improves the life for women with certain uterine pathologies such as fibroid, endometriosis and prolapse. With accurate diagnosis of patients and the route of hysterectomy, morbidity and mortality is low [5]. Ultrasonography is one of the common radiological work up which is done prior to hysterectomy with variations in sensitivity and specificity in different parts of the world. Histo-pathological examination of hysterectomy specimens carries diagnostic and therapeutic significance. We can detect out missed malignant cases , where the adjuvant treatment is dependent upon the grade and extent of the invasion of the disease It has been observed in certain areas that between 21.4% and 44.7% of the submitted samples from hysterectomy reveal no pathology after histological evaluation and for some conditions the indication will not be justified and not worth the risk [6]. Hysterectomy involves complications like excessive bleeding, infections, thromboembolism, gastrointestinal injuries, rarely nerve

injuries [7] and iatrogenic urological injuries {47.4%} [8]. Therefore for these reasons a strong and justified clinical indication is of utmost importance before planning for hysterectomy. Results from this study will provide the base line data to hospital administration and other policy makers to design appropriate interventions and may be used as a guide in protocols and guideline development regarding hysterectomy. The aim of present study is to analyse and determine the common indications of hysterectomy through assessing the histopathologic characteristics of these cases as well as determining any relationship between them and sonographic characteristics.

MATERIAL AND METHODS

Present study has been conducted over a period of one year from June 2014 to May 2015 in 100 patients attending the outpatient Department of Obstetrics and Gynaecology, Calcutta National Medical College & Hospital, Kolkata Approval from institutional ethical committee has been taken before commencing the study.

Aims
- To find out efficacy of clinical findings and USG findings with HPE findings in cases of hysterectomy.
- To find out commonest cause of hysterectomy in our set up.
- To find out any missed malignant cases by HPE in hysterectomised specimens.

Objectives
- Age distribution of patients
- Marital status & parity of patients
- Type of hysterectomy
- Various indications of hysterectomy.
- Associations between disease & type of hysterectomy (e.g. most common indication of abdominal hysterectomy e.g. fibroid)
- Management of ovaries at hysterectomy
- HPE conformation of pre-operative clinical diagnosis and USG findings.

INCLUSION CRITERIA
- Patient in the reproductive and menopausal age group (35to65years) with clinically diagnosed benign gynaecological condition with failed medical treatment like:
- Uterine leiomyoma with menstrual disturbance.
- DUB with no identifiable pathological cause but unacceptable menstrual blood loss.
- Severe and intractable endometriosis.
- Benign ovarian tumour.
- Uterine prolapse.

- Pelvic inflammatory disease with pelvic pain and severe dysmenorrhoea.

EXCLUSION CRITERIA
- Patient with emergency hysterectomy for post-partum haemorrhage.
- Clinically diagnosed malignant cases.

Those patients who attended OPD in OBG Dept. were examined clinically and by USG and then selected and asked for voluntary participation after informed consent and meeting the inclusion criteria. TVS was preferred mode in all the cases except third degree uterine prolapse and procidentia. Only these patients were examined by transabdominal sonography. The type and route of hysterectomy were determined according to pathology as well as surgeon's expertise. The gross (macroscopic) features of the specimen were noted and then specimens were immediately fixed with 10% formalin and send to pathology department for microscopic evaluation. Multiple bits were taken from the representative sites, processed and paraffin blocks were made. The blocks were sectioned and stained with haematoxylin and eosin. A detailed microscopic examination of the tumours was done to arrive at an accurate diagnosis. In cases of more than one pathologic diagnosis, both diagnoses were counted by including them separately in their assigned category.
Statistical analysis

Categorical variables were summarized in percentages. Continuous data was described as means or medians. The data were analysed using the statistical package of SPSS (version 16). Kappa concordance correlation coefficient was used for analytical analysis. Statistical significance was accepted if $P < 0.05$.

RESULTS AND ANALYSIS

A total of 100 hysterectomy specimens were analysed between June 2014 and May 2015. Correlation between age, parity, clinical indications, USG findings, mode of surgery and histopathological examination was made. Apart from physiological changes in the endometrium (secretory, proliferative endometrium), chronic cervicitis that were not severe and ovaries with cystic follicle, did not form the indication of hysterectomy. Thus specimens with only one or more of these findings were considered "unremarkable" histologically. In cases of multiple (>1) pathologic diagnoses, all were counted by including them individually in their assigned category.

Patients subjected for hysterectomy were in age range of 35 to 65 years. They were studied under various age groups. Overall the mean age was 45 years. Of the total cases, 51% were in the age group 41-50 years, which is the most common age group for contracting various diseases.

Table-1: Age distribution

Age group	No. of cases	%
≤ 40	33	33
41-50	51	51
51-60	10	10
>60	6	6
Total	100	100

In this study, a high incidence of disease was seen in women with parity of more than three (34%). Only 2% cases were nullipara. All were married except one case.

Table-2: Parity

Parity	No.	%
0	2	2
1	13	13
2	28	28
3	23	23
>3	34	34

Majority of the patients presented with abnormal bleeding (62%) like polymenorrhoea, menorrhagia, etc.; most common clinical finding among these patients was fibroid uterus (26%), followed by DUB (18%), adenomyosis (11%) and others. Second most common complaint was prolapse (commonly second degree) with back pain (34%). Some of the patients with prolapse had associated urinary incontinence. Among this group of prolapse, (17.64%) had dual pathology with either fibroid or DUB. The other indications for hysterectomy were chronic PID (3%), adnexal mass (9%) and endometriosis (2%).

Table-3: Clinical indication of hysterectomy

Clinical indication (symptoms + signs)	No. of cases	%
Abnormal bleeding due to fibroid uterus	26	26
Uterine prolapse	34	34
Adnexal mass	9	9
Abnormal bleeding due to DUB	18	18
Abnormal bleeding due to adenomyosis	11	11
Endometriosis	2	2
Chronic PID	3	3

Preoperative diagnosis was made after evaluating clinical diagnosis & USG findings. In our study, the most common pre-operative clinical diagnosis for hysterectomy was fibroid uterus (38.0%). Among fibroids, 7.9% cases were associated with prolapse, 5.2% with ovarian cysts and 7.8% with adenomyosis. Second most common indication was utero vaginal prolapse (34%). Other benign clinical indications included dysfunctional uterine bleeding (14%), adenomyosis (11%), endometriosis (1%), ovarian/adnexal mass (9%), and chronic PID (3%).

Table-4: Preoperative diagnosis

Preoperative diagnosis (based on clinical and USG findings)	No. of cases	%
DUB	14	14
Fibroid uterus	38	38
Uterine prolapse	34	34
Adenomyosis	11	11
Chronic PID	3	3
Ovarian / adnexal mass	9	9
Endometriosis	1	1

The commonest mode of surgical approach in this study was vaginal hysterectomy (53%) including 19% cases of NDVH. It is associated with a shorter hospital stay and it allows the fastest recovery and healing times. A total of 47% cases underwent abdominal surgery in which TAH +BSO was (42%), TAH with unilateral salpingo-oophorectomy in 4% and TAH in 1%. Abdominal hysterectomy was associated with more morbidity but it allowed proper visualisation of operative field and surgical exploration.

Table-5: Surgical resection

Type of surgery	No. of cases	%
TAH	1	1
TAH + BSO	42	42
TAH + USO	4	4
NDVH	19	19
VH + PFR	34	34

Most common indication of abdominal hysterectomy in our study was fibroid uterus and for vaginal hysterectomy it was prolapse.

Table-6: Association between disease and type of hysterectomy

Type of hysterectomy	Indication
Abdominal	Fibroid
VH ± PFR	Prolapse
NDVH	Fibroid

In vaginal hysterectomy, in 100% of cases both ovaries were preserved. In case of abdominal hysterectomy, routinely, both the ovaries were removed beyond the age of 45 years considering the poor socioeconomic status and lack of motivation for the follow up by the patients. Patients who were below 45 years decision on oophorectomy was based on per operative findings, like severe adhesions, cystic ovaries, presence of hydrosalpinx etc. In 42% of cases both ovaries, in 3% left ovary and in 1% right ovary was removed.

Table-7: Management of ovaries

Resection of ovaries	No. of cases
Bilateral oophorectomy	42
Unilateral oophorectomy	4
Both ovaries preserved	54

Table-8: Histopathological pattern

Histopathological findings	No of cases	%
Leiomyoma	36	36
Adenomyosis	31	31
Endometrial hyperplasia	1	1
Ovarian pathologies	9	9
Atrophic endometrium	14	14
No identified pathology	16	16

Out of 100 specimens, in the final histopathology reports, fibroid were the most common finding reported in 36%. A single leiomyoma was seen in approx. 40 % of cases and 46 % were found to be intramural. Other pathologies were adenomyosis (31%), endometrial hyperplasia (1%), atrophic endometrium (14%), combined fibroid with adenomyosis (6%), adenomyosis with CIN-1 and chronic endometritis (1%). Benign ovarian pathologies included chocolate cyst, mucinous cyst adenoma, papillary serous cyst adenofibroma and simple cysts. Here it is important to focus that in 16% of cases no pathology was identified as significant number of cases were of uterine prolapse. Although in our study only benign uterine pathology were evaluated, 1 case of leiomyosarcoma was detected as missed malignant case.

The histopathological confirmation of the clinical findings was 80.7% for fibroids and 63.6% for adenomyosis. Out of 18 cases which were clinically diagnosed as DUB, 55.55% came out as adenomyosis, 22.23% leiomyoma and no identified pathology in 16.7%. So, there was poor correlation for DUB. In case of adnexal/ovarian mass, 88.9% cases correlated with histopathology. Only 1 case of broad ligament fibroid was misdiagnosed as ovarian mass. Hysterectomies which were done for uterovaginal prolapse showed atrophic endometria and no identified pathology in 70.58%. The overall (mean) correlation with HPE comes out to be 63%.

Table-9: Correlation between clinical & histopathological findings

Clinical indication	Histopathological findings	
Fibroid (26 cases)	Leiomyoma	21 (80.79)%
Adenomyosis (11 cases)	Adenomyosis	7 (63.64)%
Uterine prolapse (34 cases)	Atrophied & normal histology	24 (70.58)%
DUB 18 cases	Leiomyoma	4 (22.22)%
	Adenomyosis	10 (55.55)%
	No identified pathology	3 (16.6)%
Adnexal mass 9 cases	Leiomyoma	1 (11.11)%
	Benign ovarian pathology	8 (88.89)%
Endometriosis 2 cases	No identified pathology	1 (50)%
	Benign ovarian pathology	1 (50)%
Chronic PID 3 cases	No identified pathology	2 (66.67%)
	Others	1 (33.33%)

For fibroid: KAPPA value is 0.564 which shows intermediate agreement and p value 0.001

For adenomyosis
KAPPA value is 0.25 (poor agreement) and p value 0.004

In our study, all patients underwent ultrasound scanning in which 67.5% of leiomyoma and 63.63% of adenomyosis were correlated with the histopathological examination. In case of bulky uterus 41% came out as adenomyosis, 9% cases leiomyoma and 45.45% cases showed no identified pathology. Among patients showing normal scan, 52.17% had atrophic endometrium and in 22% no abnormality detected on histology. Majority of these cases were of uterine prolapse. Ultrasound scan of ovarian/adnexal mass showed 90.9% correlation with histopathology. Only 9% case came out as fibroid.

Table-10: Correlation between usg and histopathological findings

USG FINDINGS	HPE FINDINGS	
Bulky uterus 22 cases	Leiomyoma	2 (9.09%)
	Adenomyosis	9 (40.91%)
	Atrophied+ No identified pathology	10 (45.45%)
	Others	1 (4.54%)
Fibroid uterus 37 cases	Leiomyoma	25 (67.57%)
	Adenomyosis	7(18.92%)
	Others	5 (13.51%)
Adenomyosis 11 cases	Adenomyosis	7 (63.63%)
	Others	4 (27.27%)
Adnexal mass 11 cases	Benign ovarian pathology	10 (90.91%)
	Leiomyoma	1 (9.09%)
Normal scan 23 cases	Atrophied endometrium	12 (52.17%)
	Leiomyoma	1 (4.35%)
	No identified pathology	5 (21.74%)
	Endometrial hyperplasia	1 (4.35%)
	Others	4 (17.39%)

Fibroid in USG
KAPPA value is 0.74 which shows good agreement and p value 0.001

Adenomyosis in USG
KAPPA value is 0.25 (poor agreement) and p value 0.001

The most common preoperative indication for hysterectomy was fibroid uterus (38%) among which 92.10% showed correlation with HPE. Correlation for adenomyosis was 72.72% and for DUB was very poor. Out of 14 cases of DUB (57.14%) came out as adenomyosis, 14.28% fibroid and (7%) showed no identified pathology. Out of 34 cases of POP, (82.35%) showed normal or atrophied endometrium. 1 case of fibroid showed leiomyosarcoma on HPE

Table-11: Correlation between preoperative diagnoses and hpe findings

PREOPERATIVE FINDINGS (USG + CLINICAL)	HPE FINDINGS	
DUB 14 cases	Adenomyosis	8 (57.14%)
	Leiomyoma	2 (14.28%)
	No identified pathology	1 (7.14%)
Fibroid 38cases	Leiomyoma	35 (92.10%)
Prolapse 34 cases	Atrophied & no identified pathology	28 (82.35%)
	Leiomyoma	3 (8.82%)
	Adenomyosis	2 (5.88%)
Adenomyosis 11cases	Adenomyosis	8 (72.72%)
Chronic PID 3 cases	No identified pathology	2 (66.67%)
Adnexal mass 9 cases	Benign ovarian pathology	8(88.89%)
	Leiomyoma	1(11.11%)

The overall (mean) correlation for preoperative diagnosis comes out to be 81%.

DISCUSSION

The study was conducted in Calcutta National Medical College & hospital. It was a prospective, observational study during the period of June 2014 to May 2015. It involved 100 patients. The mean age at hysterectomy in this study was 45 years with most common age group 41 to 50 years. A majority of the diseases was seen with a parity of more than 3. Similar results were obtained by Thamilsalvi *et al.* [9]. In a study in Nepal, by Jha R et al, the mean age of the women who underwent hysterectomy was 46.3 years [10]. A majority of the women were parous, with a mean parity of 5. Lee NC found a mean parity of 3.1 [11].

The commonest presenting symptom in the study population was menorrhagia, dysmenorrhoea and other menstrual problems (62%). This was also observed by Thamilselvi [9] and Shakira p *et al.* [12]. Also in study by Shergill SK abnormal menstrual flow was the commonest complaint which was seen in 66% of the cases [13].

In our study, 90 patients underwent transvaginal ultrasound and only 10 patients underwent pelvic ultrasound due to third degree prolapse and procidentia. Transabdominal sonography does not allow a reliable diagnosis of adenomyosis or its consistent differentiation from leiomyoma. Even TVS has limitations in tissue characterization. MRI is more helpful in diagnosing adenomyosis but it is expensive. MRI has shown a high diagnostic accuracy of adenomyosis of up to 85% but in absence of co-existence with leiomyoma; the diagnostic accuracy of trans-vaginal scan and MRI are similar [14.] Therefore instead of using expensive MRI in diagnosis of adenomyosis, trans-vaginal is used with satisfactory diagnostic efficacy. In our study incidence of fibroid on USG was 37%, adenomyosis 11%, adnexal/ovarian mass 9%, bulky uterus 22% and normal scan in 23% of cases.

The commonest preoperative indication for hysterectomy in our study was fibroid (38%) followed by prolapse (34 %). It is consistent with other studies. In the study by Shergill SK, the commonest indication was fibroid (34%), followed by DUB (26%) [25]. Jha R found that leiomyoma was the indication in 24.9%, ovarian tumour in 14.9% and DUB in 7.7% of the cases [10]. Clarke A reported the commonest indication to be DUB (58%), followed by fibroids (23.2%) [15]. But in study by Thamilselvi *et al.* [9] and Kotasthane [16], the main indication for hysterectomy was utero-vaginal prolapse, 31.6% and 40% respectively followed by uterine leiomyoma.

In our study, the route of surgery was determined based on pathology, patient's own choice, her decision to preserve the ovaries and surgeon's expertise. The commonest type of resection done was vaginal hysterectomy in 53 % of cases including 19 % cases of NDVH. A total of 47 % cases underwent abdominal surgery in which TAH +BSO was (42%), TAH 1%. Chryssiopoulos et al studied 3410 total hysterectomies over a period of 16 years. In this study abdominal approach was preferred in 85.33% and the vaginal route in 14.67% of cases [17]. The abdominal route is associated with a longer hospital stay, increased complications and higher costs. Vaginal hysterectomy is associated with a shorter hospital stay and it allows the fastest recovery and healing times so nowadays this route is encouraged. In Australia, France and Finland the number of vaginal hysterectomies reported is greater than the number of abdominally performed procedures.

The most common indication of abdominal hysterectomy in our set up was fibroid while for vaginal hysterectomy it was prolapse. In vaginal hysterectomy, in all cases (53 %) both ovaries were preserved. In case of abdominal hysterectomy, routinely, both the ovaries were removed beyond the age of 45 yrs. considering the poor socioeconomic status and lack of motivation for the follow up by the patients. Patients who were below 45 yrs. decision on oophorectomy were based on per operative findings like severe adhesions, cystic ovaries, presence of hydrosalpinx.

On reviewing the histopathology reports, leiomyoma was found to be the most common diagnosis in our study (36%), followed by adenomyosis (31%). Similar results were obtained by Karthikeyan, T. M., *et al.* [18] were leiomyoma was (41%) followed by adenomyosis (15.5%) Sobande AA also found that fibroids were the most common pathology which was seen in 25.8% of the hysterectomy specimens followed by adenomyosis (22.7%)

In our study no pathology was identified in (16%)[6]. Although slightly higher; similar pattern was observed in Mirpurkhas in 21.4% of hysterectomy [19]. This is probably associated with evaluation of each and every hysterectomy sample regardless of physical appearance and suspected diagnosis. Other diagnosis like dysfunctional uterine bleeding and pelvic organ prolapse might not have any histological findings detected. This was observed in South Africa; for those with pelvic organ prolapse in up to 84% of samples there was no any identified pathology [20]. In our study, one missed malignant case of leiomyosarcoma was found.

In our study, overall clinical diagnosis was confirmed in 63% of cases. In case of leiomyoma, the sensitivity was 58.33% whereas the specificity was 92.18%. The agreement between clinical diagnosis of leiomyoma and histological findings was found to be 56.4% which is intermediate (k=0.564). In case of adenomyosis, however, it was 24.7% showing poor agreement. For DUB conformation was poor where 55.6% of cases came out as adenomyosis and 22.2% as leiomyoma. Miller studied 246 hysterectomy specimens and found that 50% of clinical diagnoses were confirmed in HPE [21].

Our clinical diagnosis is usually modified according to ultrasonological findings. Preoperative diagnosis is made based on both clinical and sonological outcome. In our study 80-81% of preoperative diagnosis was confirmed by histopathology. Similar results were obtained by Lee NC who found that out of the 1283 women whom they studied, 80% of the pre-operative diagnoses were confirmed in the potentially confirmable group [11]. In study by Thamilselvi et al, on the 243 women, 88.8% of the pre-operative diagnoses were confirmed by histopathology [9]. Pandey, Deeksha et al found that, around 84% had the same pathology as suspected preoperatively [22].

While correlating sonological findings with histopathology in our study, we found that out of the 37 patients who were diagnosed to have fibroid uterus on ultrasonography, 25 patients were confirmed to have leiomyoma on histopathology showing excellent correlation (k=0.74). In case of adenomyosis, 7 out of 11cases on USG were confirmed on histopathology. The degree of agreement was poor (k=0.25).There are only few studies showing this correlation. In a study done in Nigeria ultrasound detected 87% of uterine myomawith sensitivity of 94.5% and specificity of 62.5% . In another study ultrasound correlated 95% of uterine myoma to histopathological diagnosis [23, 24].

Although this study was a small scale study it provides a basis for future audit of hysterectomy at CNMCH. The data from this study will aid in pre-operative counselling and decision making with regard to the type of hysterectomy performed.

CONCLUSION

The mean age of hysterectomy was 45 yrs. with parity of more than 3. The commonest presenting symptom was menstrual abnormality .followed by prolapse. Clinically the incidence of fibroid was highest followed by DUB, adenomyosis and adnexal mass. The most common preoperative indication based on clinical and USG findings was fibroid uterus followed by prolapse. In our study vaginal hysterectomy was most common surgical approach followed by abdominal hysterectomy. Fibroids were most common indication for abdominal hysterectomy while for vaginal hysterectomy it was uterine prolapse. Regarding management of ovaries, in all cases of vaginal hysterectomy both ovaries were preserved. In abdominal hysterectomy both ovaries were preserved in 2cases %. In our study, routinely both the ovaries were removed beyond the age of 45 yrs. considering the poor socioeconomic status and lack of motivation for the follow up by the patients.

On histopathological examination leiomyoma was commonest diagnosis followed by adenomyosis. Many specimens showed more than one pathology. One missed malignant case of leiomyosarcoma was detected in our study.

It is important to assess agreement between clinical indications, USG findings with final histopathological diagnosis. The degree of agreement between clinical diagnosis of leiomyoma and histological findings was found to be intermediate (k=0.564). In case of adenomyosis, however, kappa value was 0.247 showing poor agreement

While correlating sonological findings with histopathology in our study, we found that in case of leiomyoma there was excellent correlation (k=0.74). In

case of adenomyosis, 7 out of 11cases on USG were confirmed on histopathology. The degree of agreement was poor (k=0.25).

From the present study, it is concluded that:
- Combined approach is better than any of the single approach for diagnosis of uterine pathology. So, clinical findings should be combined with ultrasonological findings for better collaboration with histopathology.
- Each sample should be taken for histological evaluation regardless of physical appearance of the uterus. Although one but it was observed that the patient had leiomyosarcoma associated with leiomyoma. Malignant finding changed the treatment modality.
- In our study though transvaginal sonography was used for radiological scanning, correlation of adenomyosis with histopathology was poor with kappa value 0.25. Further survey is needed to explain it.
- In our study fibroid, uterine prolapse and adenomyosis were major indications for hysterectomy but incidence of this disease was common in patients with parity more than 3. This is not explained except in case of prolapse.
- In our study correlation for DUB was poor. A majority of cases were diagnosed as adenomyosis.
- In this study, uterine prolapse was second most common cause for hysterectomy, incidence of which can be reduced by preventive measures in reproductive age group.

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